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EXAMINER

NGUYEN, KHIEM D

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 08/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/998,384

Applicant(s)

YOUNG JOSEPH PAIK

Examiner

Khiem D Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) 21-24, 36 and 39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20, 25-35, 37 and 38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 032904.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION***Election/Restrictions***

Applicant's election with traverse of claims 1-20, 25-35, and 37-38 in the reply filed on July 12th, 2004 is acknowledged. The traversal is on the ground(s) that (See the restriction). This is not found persuasive because the inventions are distinct if it can be shown that the process as claimed can be practiced by another materially different apparatus or by hand such as one in which the human interface can be substituted for the computer medium in the chemical mechanical polishing (CMP) process. Additionally, since these inventions have acquired a separate status in the art as shown by their different classification, restriction for the examination purposes as indicated is proper. The requirement is still deemed proper and is therefore made FINAL.

Claim Objections

Claim 8 is objected to because of the following informalities: In claim 8, line 4, recited the term "prediction error". Predictions are not patently enforceable. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-7, 9-11, 13, 25-34, and 38 are rejected under 35 U.S.C. 102(b) as being anticipated by Meikle et al. (U.S. Patent 5,655,951).

In re claim 1, **Meikle** discloses a method of conditioning a planarizing surface in a chemical mechanical polishing (CMP) apparatus having a polishing pad **40** against which a wafer **60** is positioned for removal of material therefrom and a conditioning disk is positioned for conditioning of the polishing pad, comprising the steps of (col. 5, lines 33-61 and **FIG. 7**):

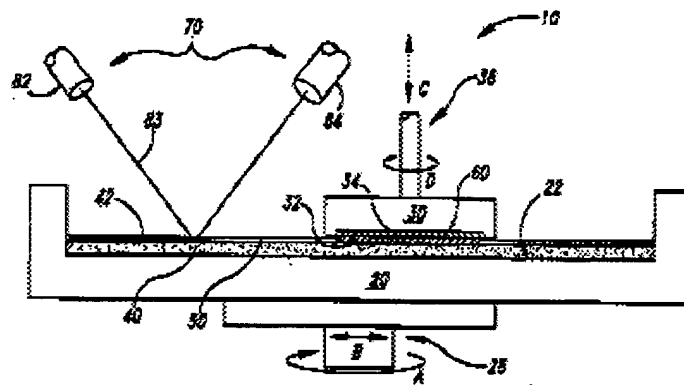


Fig. 7

a) providing a pad wear and conditioning model that defines wafer material removal rate as a function of at least one pad conditioning parameters, the at least one conditioning parameter having maximum and minimum values (col. 5, line 33 to col. 6 line 30 and **FIG. 8**);

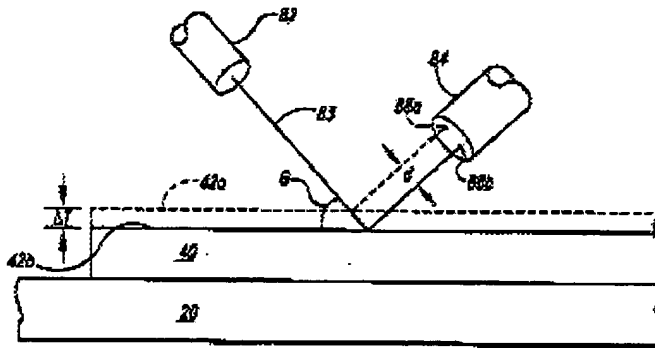
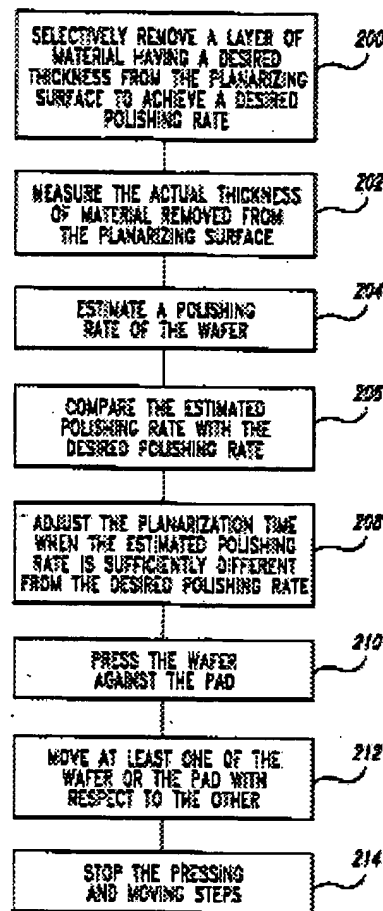


Fig. 8

b) polishing a wafer in the CMP apparatus under a first set of pad conditioning parameters selected to maintain wafer material removal rates within preselected minimum and maximum removal rates (**FIG. 8**);

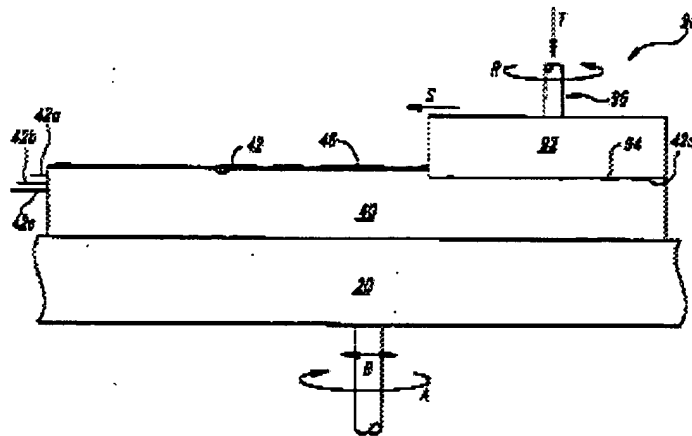
c) determining a wafer material removal rate occurring during said polishing step (col. 6, lines 31-56 and **FIG. 6**);

*Fig. 6*

d) calculating updated pad conditioning parameters based upon said determined wafer material removal rate of said step (c) and the pad wear and conditioning model to maintain wafer material removal rates within the maximum and minimum removal rates (col. 6, lines 31-36 and **FIG. 6**); and

e) conditioning the polishing pad using the updated conditioning parameters (col. 7, lines 46-64).

In re claim 2, Meikle discloses wherein the conditioning parameters comprise conditioning down force **T** (col. 5, lines 33-61 and **FIG. 4**).

*Fig. 4*

In re claim 3, **Meikle** discloses wherein the conditioning parameters comprise rotational velocity **R** of the conditioning disk **92** (col. 5, lines 33-61 and FIG. 4).

In re claim 4, **Meikle** discloses wherein the conditioning parameters comprise one or more parameters selected from the group consisting of rotational velocity **R** of the disk **92**, frequency of conditioning, duration of conditioning and translational speed of the conditioning disk (col. 5, lines 33 to col. 6, line 31 and FIG. 4).

In re claim 5, **Meikle** discloses wherein the step of calculating updated conditioning parameters includes calculating parameters such that the parameter is within the determined minimum and maximum values (col. 6, lines 6-30).

In re claim 6, **Meikle** discloses wherein the updated pad conditioning parameters are calculated by determining the difference between an output of the pad wear and conditioning model and the determined wafer material removal of step (c) (col. 7, lines 46-64).

In re claim 7, Meikle discloses wherein the difference is adjusted using an estimate gain prior to calculating updated conditioning parameters (col. 6, lines 31-65).

In re claim 9, Meikle discloses wherein the steps b) through e) are repeated (col. 6, lines 31-65 and FIGS. 6-8).

In re claim 10, Meikle discloses wherein the first set of pad conditioning parameters are determined empirically (col. 6, lines 6-30).

In re claim 11, Meikle discloses wherein the first set of pad conditioning parameters are determined using historical data (FIG. 3).

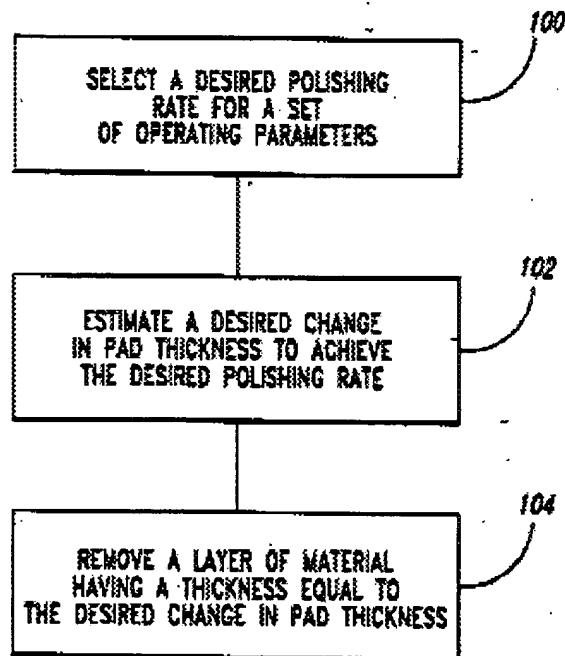


Fig. 3

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In re claim 13, Meikle discloses wherein the maximum value for wafer material removal rate is the saturation point of the wafer material removal rate vs. conditioning down force curve (col. 5, lines 33-61 and **FIG. 5**).

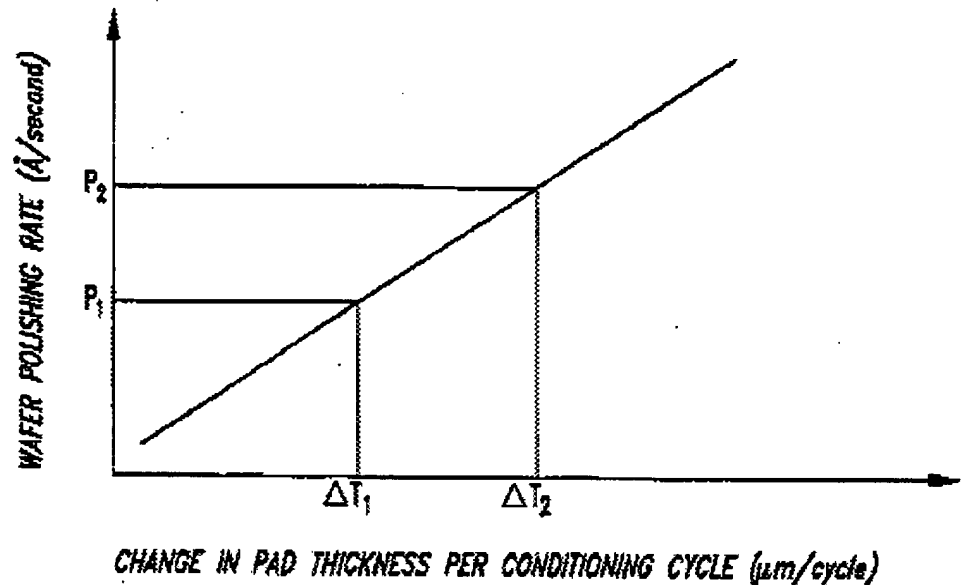


Fig. 5

In re claim 25, Meikle discloses a method of developing a pad wear and pad conditioning model for optimization of the pad conditioning, comprising the steps of: determining the relationship between at least one pad conditioning parameter and wafer material removal rate; determining maximum and minimum values for each of the at least one pad conditioning parameters and the wafer material removal rate; and recording the relationships and minimum and maximum values of the at least one pad conditioning parameter and the wafer removal rate (col. 6, lines 31-56 and **FIGS. 6-8**).

In re claim 26, Meikle discloses wherein the at least one pad conditioning parameter comprises a plurality of parameters and the wafer removal rate is defined as a weighted function of the plurality of pad conditioning parameters (col. 5, lines 33-61 and **FIG. 4**).

In re claim 27, Meikle discloses wherein the at least one pad conditioning parameters comprise conditioning down force T (col. 5, lines 33-61 and **FIG. 4**).

In re claim 28, Meikle discloses wherein the at least one pad conditioning parameter further comprises conditioning disk rotational rate 92 (col. 5, lines 33-61 and **FIG. 4**).

In re claim 29, Meikle discloses wherein the at least one pad conditioning parameters comprises one or more parameters selected from the group consisting of conditioning disk down force, conditional disk rotational rate, frequency of conditioning, and conditioning disk translational speed (col. 5, lines 33 to col. 6, line 31 and **FIG. 4**).

In re claim 30, Meikle discloses wherein the relationship between the at least one conditioning parameter and wafer removal rate is determined by incrementally varying the conditioning parameter and measuring the resultant wafer removal rate (col. 6, lines 31-56 and **FIGS. 6-8**).

In re claim 31, Meikle discloses wherein the maximum value for the conditioning parameter is the value above which no incremental increase of the wafer removal rate is observed (col. 6, lines 31-36 and **FIGS. 6-8**).

In re claim 32, Meikle discloses wherein the minimum value for the conditioning parameter is the value which provides the minimum wafer removal rate (col. 6, lines 31-36 and **FIGS. 6-8**).

In re claim 33, Meikle discloses wherein the method of claim 25, further comprising the steps of: polishing a wafer in the CMP apparatus under a first set of pad conditioning parameters selected to maintain wafer material removal rates within preselected minimum and maximum removal rates (col. 5, line 33 to col. 6, line 30 and **FIG. 8**); determining a wafer material removal rate occurring during the polishing step (col. 6, line 31-56 and **FIG. 6**); calculating updated pad conditioning parameters based upon said determined wafer material removal rate and the pad wear and conditioning model to maintain wafer material removal rates within the maximum and minimum removal rates (col. 6, lines 31-56 and **FIG. 6**); and conditioning the polishing pad using the updated pad conditioning parameters (col. 7, lines 46-64).

In re claim 34, Meikle discloses wherein the updated pad conditioning parameters are calculated by determining the difference between an output of the pad wear and conditioning model and the determined wafer material removal of step (c) (col. 7, lines 46-64).

In re claim 38, Meikle discloses a system for conditioning a planarizing surface in a chemical mechanical polishing (CMP) apparatus having a polishing pad and a conditioning disk, comprising: a) a pad wear and conditioning model that defines wafer material removal rate as a function of at least one pad conditioning parameters including rotation and direction of the conditioning disk

(col. 5, lines 33-61 and **FIG. 7**); b) polishing means for polishing a wafer in the CMP apparatus (**FIG. 8**); c) measuring means for determining a wafer material removal rate (col. 6, lines 31-56 and **FIGS. 6-8**); and d) calculating means for updating pad conditioning parameters based upon said determined wafer material removal rate of said step (c) and the pad wear and conditioning model to maintain wafer material removal rates within the maximum and minimum removal rates (col. 6, lines 31-56 and **FIGS. 6-8**).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 8, 12, 14-20, 35, and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meikle et al. (U.S. Patent 5,655,951).

In re claim 37, Meikle discloses a method of conditioning a planarizing surface in a chemical mechanical polishing (CMP) apparatus having a polishing pad against which a wafer is positioned for removal of material therefrom and a conditioning disk is positioned for conditioning of the polishing pad, comprising the steps of (col. 5, lines 33-61 and **FIG. 7**): (a) developing a pad wear and pad conditioning model by: (i) determining the relationship between at least one pad conditioning parameter and wafer material removal rate (col. 5, line 33 to col. 6, line 30 and **FIG. 8**); (ii) determining maximum and minimum values for each of the at least one pad conditioning parameters and the wafer material removal rate

(col. 6, lines 31-56 and **FIGS. 6-8**); (iii) recording the relationships and minimum and maximum values of the at least one pad conditioning parameter and the wafer removal rate (col. 6, lines 31-56 and **FIGS. 6-8**). (b) polishing a wafer in the CMP apparatus under a first set of pad conditioning parameters selected to maintain wafer material removal rates within preselected minimum and maximum removal rates (**FIG. 8**); (c) determining a wafer material removal rate occurring during said polishing step (col. 6, lines 31-56 and **FIG. 6**); (d) calculating updated pad conditioning parameters based upon said determined wafer material removal rate of said step (b) and the pad wear and conditioning model to maintain wafer material removal rates within the maximum and minimum removal rates (col. 6, lines 31-56 and **FIG. 6**); and (e) conditioning the polishing pad using the updated conditioning parameters (col. 7, lines 46-64).

In re claims 8, 12, 14-20, 35, and 37, there is no evidence indicating the updated pad conditioning parameters updated according to the equation as recited in claims 8 and 35, the first set of pad conditioning parameters determined using the results of a design of experimental (DOE) used to develop the model as recited in claim 12, the minimum value for wafer material removal rate defined by the maximum acceptable wafer polishing time as recited in claim 14, executing a recursive optimization process recited in claim 15, the estimate gain as recited in claim 16, the pad life defined according to the equation as recited in claim 17, the wafer material removal rate defined by the equation in claim 18, the wafer material removal rate determined according to the equation as recited in claims 19 and 37, and the updated pad conditioning parameter determined by the equation

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as recited in claims 20 and 37 is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (571) 272-1865. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (571) 272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

K.N.



**W. DAVID COLEMAN
PRIMARY EXAMINER**